Center Innovation Fund: JSC CIF

Characterization of Electrospray Ionization for Spaceflight Water Monitoring

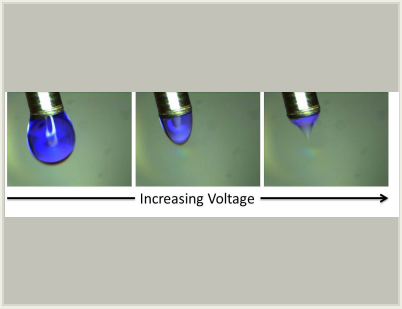
Completed Technology Project (2012 - 2012)

Project Introduction

Current methods for monitoring the water used on the International Space Station (ISS) rely heavily on ground analysis of archival samples. Air monitors presently on board the ISS could be used for trace analysis of the water samples. Electrospray ionization (ESI) is a powerful and widely used ionization technique for analysis of bio-molecules in solution and provides a potential means for introducing water into the current monitors. Ions are formed in liquid droplets and these droplets behave differently depending on the composition of the liquid. A ground study is important to characterize the spray produced from different liquid compositions in an ESI source as a first step to proposing an ESI flight experiment. This study will serve as the baseline for the flight experiment, where the effect of microgravity on electrospray is unknown. Different liquid compositions will be used in an attempt to affect the surface tension and conductivity, and, therefore, the power requirements to form an electrospray. Solutions mimicking the ISS water samples will be tested to determine if the sprays produced require different parameters from those produced using different dopants. The intended product of this project will be a report detailing the effects of solution composition, needle size, and solution flow rate using the ESI source. These results will provide a baseline for an on-orbit ESI experiment, which might eventually lead to a new ionization source for water sample analysis. A successful completion of this project will lead to a proposal aimed at studying ESI as a station detailed test objective. As ESI is currently used in ground-based studies of biomolecules, further testing of this technique for on-orbit medical monitoring may be pursued.

Anticipated Benefits

The ability to analyze water samples (and possibly biological fluids) on orbit will limit/eliminate the need for sample return. If it is possible to use the water samples "as is" in the monitoring instruments, potential consumables required for on-orbit water monitoring could be eliminated. Additionally, by introducing liquid samples into the gas-phase, it may be possible to use an air analyzer for both air and water monitoring.



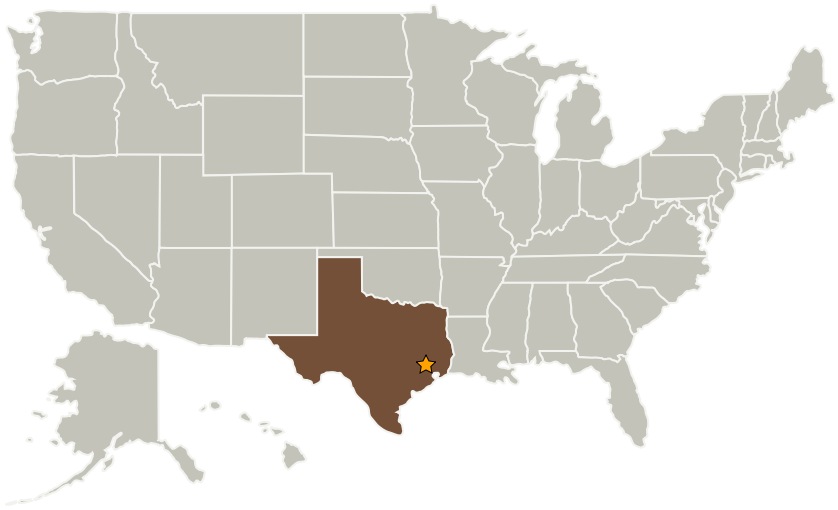
Project Image Characterization of Electrospray Ionization for Spaceflight Water Monitoring

Table of Contents

Characterization of Electrospray Ionization for Spaceflight Water Monitoring

Completed Technology Project (2012 - 2012)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Tietronix Software, Inc.	Supporting Organization	Industry Small Disadvantaged Business (SDB)	Houston, Texas
Wyle Integrated Science and Engineering Group	Supporting Organization	Industry	

Primary U.S. Work Locations
Texas

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Center Innovation Fund: JSC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

Carlos H Westhelle

Project Manager:

Ariel V Macatangay

Principal Investigator:

William T Wallace

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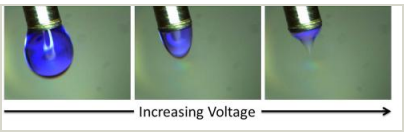
Images



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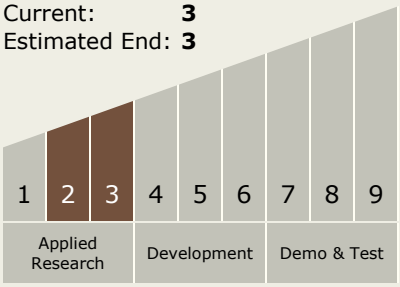
Project Image Characterization of Electrospray Ionization for Spaceflight Water Monitoring
(https://techport.nasa.gov/image/2188)

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.2 Electric Space Propulsion
    - TX01.2.2 Electrostatic